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Enclosed for filing is a patent application entitled
SYSTEM FOR GENERATING PRESCRIBED DURATION AUDIO AND/OR VIDEO SEQUENCES
by GEOFFREY C. HUFFORD, CHRISTOPHER P. HUFFORD, and KEVIN C. KLINGLER

- ☒ This is a continuation-in-part of application Serial No. 08/532,527 filed 9/22/95.
☒ Enclosed is an Assignment for recordation.
☒ Enclosed is a verified statement to establish small entity status.
☒ Enclosed are 12 sheets of drawings.
☒ Enclosed is a duplicate copy of this sheet.

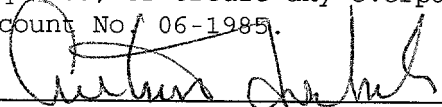
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ITEM	CLAIMS		SMALL ENTITY		NON SM. ENTITY	
	# Filed	# Extra	Rate	Fee	Rate	Fee
1. Basic Fee:				395		790
2. Total Claims:	<u>19</u>	- 20 = <u>0</u>	x11 =	<u>0</u>	x 22 =	<u> </u>
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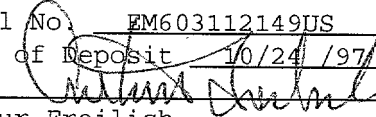
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Arthur Freilich

1 TITLE: SYSTEM FOR GENERATING PRESCRIBED DURATION
2 AUDIO AND/OR VIDEO SEQUENCES

3 INVENTORS: GEOFFREY C. HUFFORD, CHRISTOPHER P. HUFFORD,
4 KEVIN C. KLINGLER
5

6 This application is a continuation in part of
7 application Ser. No. 08/532,527, filed September 22, 1995, now
8 allowed.
9

10 BACKGROUND OF THE INVENTION

11 The present invention relates generally to
12 hardware/software systems for generating audio and/or video
13 sequences of prescribed duration and more particularly to such
14 systems suitable for generating and correlating such sequences
15 for producing multimedia presentations.

16 Exemplary multimedia presentations are formed from
17 video source material, e.g., a video segment such as a film clip,
18 and audio source material, e.g., an audio segment such as a sound
19 track. Typically, the video source segment must be edited many
20 times before an aesthetically satisfactory and proper duration
21 video output sequence is achieved. The audio source segment must
22 similarly be edited to form an audio output sequence that matches
23 the duration of the edited video output sequence.

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SUMMARY OF THE INVENTION

The present invention is directed toward a system for compiling a sequence of data blocks for producing an audio and/or video output sequence having a duration corresponding to user-prescribed criteria.

In a preferred embodiment, a user (via a keyboard and/or mouse and a display monitor) chooses an audio and/or video source segment from a data storage library storing data representing original sound tracks, MIDI data, film clips, animation clips, etc., and prescribes the desired duration of an audio and/or video output sequence. Each segment in the data storage library is divided into data blocks whose characteristics are identified in a stored characteristic data table. Exemplary characteristics include (1) duration, (2) suitability for being used as a beginning or ending of an output sequence, and (3) interblock compatibility. Using this stored characteristic table and user-prescribed criteria (e.g., a duration specified via the keyboard), a block sequence compiler (preferably a software program executed by a computer) generates a plurality of audio and/or video block sequences satisfying these criteria which can be reviewed (e.g., played via an audio and/or video output device or displayed on a monitor) and/or saved for future use.

In an exemplary use, the block sequence compiler compiles a first output sequence suitable for presentation on a first channel. Optionally, the block sequence compiler can also compile one or more additional output sequences compatible with the first output sequence (according to additional stored

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1 characteristic table parameters) suitable for presentation on
2 additional output channels to create a multimedia presentation.

3 In a further aspect of a preferred embodiment, the
4 block sequence compiler is responsive a user-prescribed mood
5 parameter stored in the characteristic table.

6 In a still further aspect of a preferred embodiment,
7 the stored characteristic table additionally contains a parameter
8 that identifies blocks that are fadeable. When a fadeable block
9 is selected as an end block, the block sequence compiler can
10 truncate the fadeable end block to generate an output sequence of
11 the prescribed length which might otherwise not be achievable.

12 In a further aspect of a preferred embodiment, the
13 block sequence compiler is responsive to a user-prescribed
14 intensity parameter stored in the stored characteristic table.

15 In a still further aspect of a preferred embodiment,
16 each block is identified in the stored characteristic table as
17 having a hit point that defines the location (when present) of an
18 intensity burst. The block sequence compiler can use the hit
19 point parameter to place an intensity burst at a user-prescribed
20 location in the compiled output sequence.

21 In another aspect of a preferred embodiment, the
22 system enables a user to generate a sequence (or subsequence) of
23 data blocks which can be executed one or more times, e.g.,
24 looping, to form an output sequence of extended duration. In a
25 first variation, the compiler selects the last block of a
26 sequence which is compatible with the first block to generate a
27 repeatable sequence. Accordingly, the repeatable sequence can be
28 repetitively executed from the first to the last block and then

1 looped back to the first block. In a second variation, blocks in
2 the repeatable sequence are selected which have a reversible
3 attribute, i.e., blocks that can be played either in a forward or
4 a reverse direction. Accordingly, the repeatable sequence can be
5 repetitively played in a forward direction from the first to the
6 last block and then in a reverse direction from the last block to
7 the first block, again resulting in a sequence having an extended
8 duration.

9 Other features and advantages of the present invention
10 should become apparent from the following description of the
11 presently-preferred embodiments, taken in conjunction with the
12 accompanying drawings, which illustrate, by way of example, the
13 principles of the present invention.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 comprises a functional block diagram of a block sequence compiler in accordance with the present invention for generating audio and/or video sequences having user-prescribed durations;

FIG. 2 is a simplified diagram of a characteristic table showing the parameters associated with each audio and/or video block;

FIG. 3A is a simplified flow chart of the operation of the system of FIG. 1;

FIG. 3B is a simplified flow chart depicting the process implemented by the block sequence compiler;

FIG. 4 is an exemplary characteristic table for a fifty second source audio and/or video segment;

FIG. 5 shows the iterations performed by the block sequence compiler according to the flow chart of FIG. 3B on the characteristic table data of FIG. 4;

FIG. 6 is a simplified flow chart depicting the process implemented by the block sequence compiler to compile a repeatable audio and/or video sequence generated by looping the last block to the first block of the compiled sequence;

FIG. 7 shows the iterations performed by the block sequence compiler according to the flow chart of FIG. 6 on the characteristic table data of FIG. 8;

FIG. 8 is an exemplary characteristic table for a fifty second source audio and/or video segment used in conjunction with the flow chart of FIG. 6;

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1 FIG. 9 is a simplified flow chart depicting the
2 process implemented by the block sequence compiler by selecting
3 blocks having a reversible attribute to compile a repeatable
4 audio and/or video sequence;

5 FIG. 10 is an exemplary characteristic table for a
6 fifty second source audio and/or video segment used in
7 conjunction with the flow chart of FIG. 9;

8 FIG. 11 is block diagram an exemplary system for
9 generating multiple compatible audio and/or video channels, i.e.,
10 multimedia, according to user-prescribed criteria; and

11 FIG. 12 is a simplified diagram showing multiple audio
12 and/or video channels generated by the exemplary system of
13 FIG. 11.

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DESCRIPTION OF THE PREFERRED EMBODIMENTS

1 DESCRIPTION OF THE PREFERRED EMBODIMENTS
2 With reference now to the drawings, and particularly
3 to FIG. 1, there is shown a block diagram of a preferred
4 embodiment of an audio and/or video sequence generator 10 of the
5 present invention for compiling a sequence of data blocks
6 suitable for producing an audio and/or video output sequence
7 having a duration corresponding to user-prescribed criteria. In
8 a preferred embodiment, the sequence generator 10 is comprised of
9 a computer-executed software program, generally initially present
10 on a floppy disk, and which preferably finally resides on the
11 hard disk of a personal computer (PC) 12, e.g., a Macintosh or
12 IBM compatible PC, controlled by a processor 13. As such the
13 following discussion, relates to these preferred PC environments.
14 However, different computer platforms or hardware-only
15 implementations are also considered within the scope of the
16 invention.

17 The sequence generator 10 is primarily comprised of
18 (1) a data storage library 14 (preferably comprised of data
19 blocks corresponding to or pointing to audio tracks, MIDI data,
20 video clips, animation, or any other data representative of sound
21 or visual information) and (2) a block sequence compiler 16. In
22 operation, a user interface 17, e.g., a keyboard/mouse 18,
23 enables a user to select a source segment 28 from the data
24 storage library 14 and prescribe a duration. This information is
25 communicated to the block sequence compiler 16 which, under
26 control of a software program executed by the processor 13 in the
27 PC 12, fetches blocks of audio and/or video source information
28 (preferably digital data) from the data storage library 14 and,

1 according to compilation criteria described further below,
2 compiles a list of potential audio and/or video sequences that
3 are preferably temporarily stored within a potential block
4 sequence list depository 19. In the case of audio (e.g., an
5 audio track or MIDI data) output sequence, the user can select to
6 play the audio sequence via a sound card/speaker 20, review a
7 list of potential block sequences via a monitor 21, or store
8 selected sequences for future use, e.g., on a hard disk 22.
9 Alternatively, in the case of a video sequence (e.g., video clip
10 or animation data), the user can select to play the video
11 sequence (preferably via a video card 24 and monitor 21), review
12 a list of potential block sequences via the monitor 21, or store
13 selected sequences for future use, e.g., on the hard disk 22. In
14 either case, the block sequence compiler 16 can preferably be
15 directed to only compile a single audio and/or video output
16 sequence and then wait until prompted by the user to generate a
17 next audio and/or video output sequence.

18 The data storage library 14 preferably contains
19 library entries 26 pertaining to a plurality of audio and/or
20 video source segments. Each library entry 26 is comprised of (1)
21 an audio and/or video source segment 28 and (2) a stored
22 characteristic data table 30 which describes the partitioning of
23 the audio and/or video source segment 28 into multiple data
24 blocks and the characteristics of each block. Although, the
25 source segment 28 is shown as being located within the data
26 storage library 14, one of ordinary skill in the art will
27 recognize that the source segment 28 can alternatively be
28 physically located outside of the library, e.g., on a CD-ROM or

1 DVD, and referenced, e.g., by pointers, by the characteristic
2 table 30. FIG. 2 shows an exemplary structure for the
3 characteristic table 30. Each entry 26 in the characteristic
4 table 30 contains a definition/pointer 32 which includes
5 identifying information for the library entry, e.g., a title and
6 the physical location of the audio and/or video source segment
7 28, e.g., a CD-ROM file. Each characteristic table entry 30 is
8 further divided into a plurality of entries that define blocks,
9 i.e., audio and/or video data blocks, and associated
10 characteristics for the audio and/or video from the audio and/or
11 video source segment 28.

12 In a simplified example, an audio and/or video source
13 segment 28 is divided into five blocks: A, B, C, D, E, F where
14 the sequence ABCDEF corresponds to the audio and/or video source
15 segment 28. Although, other combinations of blocks, e.g.,
16 FEDCBA, can also create audio and/or video sequences, not all
17 block sequences will create aesthetically reasonable audio and/or
18 video sequences. Thus, information is preferably derived to
19 determine interblock compatibility, i.e., the ability of a block
20 to sequentially follow (or alternatively sequentially precede)
21 each other block according to aesthetic, e.g., musical, criteria.
22 For example, while block C may reasonably follow block B, it may
23 not be aesthetically reasonable for it to follow block A.
24 Additionally, while some blocks, e.g., A, are suitable according
25 to aesthetic criteria to reasonably start an audio and/or video
26 sequence, other blocks are not. Similarly, only certain blocks,
27 e.g., F, are suitable according to aesthetic criteria to
28 reasonably end an audio and/or video sequence. Lastly, not all

1 audio and/or video source segments 28 can reasonably be divided
2 into fixed length blocks. In fact, using reasonable aesthetic
3 criteria, blocks will generally be differently sized.
4 Consequently, audio and/or video sequences of many different
5 durations can be achieved by combining different combinations of
6 these differently-sized blocks. However, as previously
7 described, the available combinations are limited by the
8 compatibility between potentially adjacent blocks as well as
9 their suitability to begin or end an audio and/or video sequence.
10 Corresponding to these criteria, data in the characteristic table
11 30 contains parameters for each audio and/or video block
12 pertaining to a (1) duration 34, (2) type attribute (e.g.,
13 beginning/ending) 36, and (3) an interblock compatibility list 38
14 (e.g., a list of which blocks can aesthetically follow and/or
15 precede the current block). Additionally, information (not
16 shown) identifying the physical location of each audio and/or
17 video block in the audio and/or video source segment 28 is
18 preferably retained in the characteristic table 30. While data
19 in the characteristic table 30 can be manually generated,
20 automated procedures are also possible.

21 FIG. 3B shows a simplified flow chart exemplary of the
22 iterative process implemented by the block sequence compiler 16
23 after being provided the user-prescribed data (as shown in
24 FIG. 3A). As previously described, after the user has determined
25 a selection 40 from the data storage library 14 and a duration
26 42, the block sequence compiler 16 operates on the data in the
27 characteristic table 30 according to the flow chart of FIG. 3B.
28 Accordingly, a list of potential output sequences is compiled

1 that conform to the characteristic table 30 and these sequences
2 are stored in the potential block sequence list 19. In order to
3 conform to the characteristic table, each block in an output
4 sequence must be compatible with each adjacent block according to
5 its interblock compatibility characteristic 38, i.e., each block
6 must be compatible with blocks which directly precede and follow
7 in an output sequence. Additionally, it is preferable that each
8 sequence begin with a block having a beginning characteristic 38
9 set and end with a block having an ending characteristic 36 set.

10 FIG. 4 shows an exemplary characteristic table for a
11 fifty second audio and/or video source segment 28. In this
12 example, the source segment is partitioned into ten blocks, each
13 being five seconds long. (While fixed length blocks exist in
14 this example, this is generally not the case). In this example,
15 blocks A and C have been marked as potential beginnings and
16 blocks E and J have been marked as potential endings. In the
17 example shown in FIG. 5, the user has selected a duration 42 of
18 thirty-five seconds for this source segment 28. Accordingly,
19 FIG. 5 shows the iterations performed by the block sequence
20 compiler 16 on the characteristic table 30 of FIG. 4 according to
21 the flow chart of FIG. 3B. FIG. 5 shows that the original audio
22 and/or video sequence has now been rearranged into three
23 potential sequences (ABCDEFGJ, ABCDEFHE, CDEFGHIJ) that each (1)
24 have the prescribed duration, (2) begin with a beginning block,
25 and (3) end with an ending block.

26 In an exemplary audio environment, the generator 10
27 allows users to quickly and easily create movie or record quality
28 music soundtracks for any application or document that can import

1 sound. The sequence generator 10 is able to accomplish this by
2 processing an audio source segment, e.g., music, in response to
3 user inputs. The user selects a musical style and sub-style from
4 a list, then specifies the length (preferably in minutes, seconds
5 and tenths of seconds). A musical source segment is selected
6 from the library that meets the user's needs and a custom version
7 of that music is created that is exactly (within user-prescribed
8 criteria) the specified length. If the user doesn't like the
9 selected music, the user can hear a different version of the same
10 music or a different piece music - all of the versions presented
11 will fit the user's specifications.

12 By using music and its corresponding characteristic
13 table 30 and input from the user, the block sequence compiler 16
14 can customize the following aspects of the music:

- 15 • The length of the music can be customized in tenths of
16 a second increments from seconds to hours.
- 17 • Different versions of the same piece of music
18 (sometimes hundreds of thousands of options) can be
19 generated.
- 20 • In an alternative embodiment, the block sequence
21 compiler 16 can customize the intensity of the music.
22 The user can define a desired intensity curve 44.
23 This will allow the user to have the program make a
24 piece of music that begins softly (perhaps while an
25 announcer speaks) and builds to a climax (perhaps when
26 the narration has ended). In this embodiment, an
27 intensity parameter 46 is added to the characteristic
28 table 30 for each block and the block sequence

1 compiler 16 selects blocks that most closely
2 correspond to the prescribed intensity curve 44.

3 • In a next alternative embodiment, the user can specify
4 a mood selection 48 to modify the mood of the music
5 without changing any other characteristics. In this
6 embodiment, a mood parameter 50 is added to
7 characteristic table 30. Additionally, multiple
8 renditions of the audio source segment 28 are
9 prerecorded corresponding to different moods. The
10 block sequence compiler 16 will then select renditions
11 that correspond to the prescribed mood parameter 50.

12 • In another alternative embodiment, a user can specify
13 a first duration of background music followed by a
14 second duration of introductory music. The compiler
15 16 will be able to locate two different pieces of
16 music and make a smooth, musical, transition between
17 them.

18 • In an additional alternative embodiment, blocks can be
19 identified with a fadeable parameter 52 in the
20 characteristic table 30. When a block is fadeable,
21 its duration can be truncated to become a satisfactory
22 end block, even if its duration would normally be too
23 long. The compiler 16 can then truncate the fadeable
24 block to achieve the user-prescribed duration.
25 Additionally, the intensity of the end of the fadeable
26 block will fade at a prescribed rate to reduce the
27 effects of the truncation.

28 //

1 • In still another embodiment, each block can be
2 identified in the characteristic table 30 as having a
3 hit point parameter 54 that defines the location (when
4 present) of an intensity burst. When prescribed by
5 the user, the block sequence compiler 16 can use the
6 hit point parameter 54 to place an intensity burst at
7 a user-prescribed location (e.g., defined by intensity
8 curve 44) in the generated audio output sequence.

9
10 Similar aspects of a corresponding video (e.g., video
11 clip or animation) sequence can also be customized by the
12 compiler 16 according to data within the characteristic table 30.
13 For example, if a static parameter 55 is placed within the
14 characteristic table 30, this parameter can be used to identify
15 blocks, preferably additionally having an ending type 36, that
16 can be extended to a desired duration and thus can be used to
17 simplify matching the user-prescribed duration 42. Accordingly,
18 especially in a video environment, the last block can end with a
19 still picture (a "freeze frame") that can be maintained as long
20 as required to produce a sequence having the prescribed duration
21 42.

22 The following defines the data structure for each
23 block of the characteristic table in this exemplary audio
24 embodiment:

25 fileInfo a pointer to which audio source segment this
26 block is associated with
27 blockStart the sample number within the audio source
28 segment at which this block begins

//

1 blockLength the number of samples that this block contains.
2 The end sample number is derived by adding
3 blockStart and blockLength
4
5 blockName the name to display on this block (no longer
6 than 15 characters
7
8 blockDesc the long text description of this block (up to
9 63 characters)
10
11 compatibility an array of bits specifying this block's
12 compatibility with all other blocks in this file
13 (described below)
14
15 usageFlags bit flags indicating properties of this block
16 (described below)
17
18 nextBlock the block number of the best block to following
19 this block
20
21 quickEnd the block number of the best next block to end
22 the music quickly
23
24 blockSection a section number of this block assigned for use
25 in grouping sub-blocks into grouped blocks for
26 display
27
28 blockPriority a priority number of this block assigned for use
29 in displaying blocks at different detail levels
30
31 blockType a set of bits specifying if this block should be
32 displayed, if the block is in-use, and other
33 status flags. USER_BLOCK_TYPE,
34 INVISIBLE_BLOCK_TYPE, AVAILABLE_BLOCK_TYPE
35
36 selected a True/False flag indicating if the block is
37 currently selected
38
39 intensity each block is assigned an intensity index in
40 relation to the other blocks in the file. The
41 higher the intensity number, the more intense
42 the audio in the block is in relation to the
43 other blocks.
44
45 hitPoint the sample number, if any, of a musical "Hit"
46 within the block. (0 for no significant hit)
47
48 moodIndex a number grouping this blocks mood with other
49 blocks mood. All blocks with the same moodIndex
50 will have the same mood.
51
52 //

1 next a pointer to the next block

2
3 Compatibility

4 Each block has an array of unsigned longs which are
5 used as an array of bits. Each bit corresponds to a block from
6 the data storage library 14, e.g., bit 15 should be set if the
7 block is compatible with block 15. Compatible blocks are blocks
8 which sound musically correct when they are played one after the
9 other. For example, Block A should be flagged as compatible with
10 Block B when it sounds musically correct to listen to Block A
11 followed by Block B. If Block B was the 24th block from the
12 library source segment, then bit 24 of Block A's compatibility
13 array should be set.

14 USAGEFLAGS

15 DEAD_END_FLAG Set if this block will lead you directly
16 toward an ending. Set this bit if this
17 block is a bad choice to build a long
18 cue
(1L<0)

19 NEXT_CONTIGUOUS_FLAG Set this bit if the next block doesn't
20 need a crossfade to make a good sounding
21 transition
(1L<1)

22 FADEABLE_BLOCK Set this bit to signal that this block
23 can be effectively faded (in volume) to
24 any length.
(1L<2)

25 BEGINING_BLOCK Set this bit if the block is a good
26 choice (sounds musically correct) to
27 begin a selection
(1L<30) // 0x40000000

28 ENDING_BLOCK Set this bit if the block is a good
choice to end a selection
(1L<31) // 0x80000000

29 //

1 While some of the above functions (further defined in
2 the data structure below) can be applied to existing music
3 (through a process of specifying block characteristics), some are
4 dependent on a custom music library in which music is composed
5 and performed in a specific format.

```
6 struct BlockStruct {
7     SoundFileInfoPtr    fileInfo; // pointer to file
8     unsigned long       blockStart; // sample number
9     unsigned long       blockLength; // number of samples
10    Str15                blockName;
11    Str63                blockDesc;
12    unsigned long        compatibility[COMPAT_SIZE];
13    unsigned long        usageFlags;
14    short                nextBlock;
15    short                quickEnd;
16    unsigned char        blockSection;
17    unsigned char        blockPriority;
18    BlockTypes           blockType;
19    Boolean               selected;
20    BlockStructPtr       next;
21 };
```

22 HINTING/WARNING

23 Using the characteristic table data associated with
24 each data block, the user is assisted by visually displaying
25 information about the blocks. Block attributes including
26 beginnings, endings and compatibility are all displayed.

27 Beginning- displayed by a stair-step pattern on
the left edge of the block

28 Ending- displayed by a stair-step pattern on
the right edge of the block

29 Compatibility- the rightmost end cap of a selection
in the sequence window is colored and
all of the compatible blocks in the
block window will have their left end
caps colored.

30 Warning- when two non-compatible blocks are
next to each other, we display a red
edge at their junction.

31 //

1 The process of specifying characteristics of music and
2 sound is both musical and technical. This process is used to
3 provide as much information as possible about each piece of music
4 or sound so that the compiler 16 can make informed, musical
5 decisions, when it manipulates the music according to requests
6 from users. This process includes the following:

- 7 1. Block Start and End: The beginning and ending of
8 each discrete music section (block) is determined.
9 This necessarily determines the length of each block.
10 Listen to the piece of music and divide it into
11 segments based on musical phrases and musical uses
12 called blocks. On average, there are fifteen blocks
13 per minute of music.
- 14 2. Block Name: Code each block with a name and
15 description.
- 16 3. Beginning Blocks: For each block a determination
17 is made as to whether it would make a good way to
18 start a musical section or phrase.
- 19 4. Ending Blocks: Same concept as that described for
20 Beginning Blocks.
- 21 5. Block Compatibility: Each block is tested for its
22 specific compatibility to each and every other block
23 which comprise the source audio segment.
- 24 6. Intensity: Code each block's musical intensity
25 relative to other blocks.
- 26 7. Fadeable Block: Each block has a determination
27 made as to whether it sounds musically viable to fade
28 or not.

22 In a further aspect of the present invention, a user
23 may alternatively prescribe a repeatable audio and/or video
24 sequence (or subsequence), e.g., a looping sequence, that is
25 capable of repeating and thus has an extended duration. In this
26 embodiment, a last block 56 of a compiled sequence 58 is chosen
27 that is compatible (according to compatibility data 38) with a
28 first block 60 of the compiled sequence 58. While the

1 beginning/ending attribute 36 is of limited significance with
2 such a repeatable sequence (and accordingly an ending attribute
3 is preferably not required), it is still aesthetically preferable
4 that the sequence initially begin with a block having a beginning
5 attribute. Additionally, while a principal duration 62 of the
6 compiled block sequence (the time duration from the beginning of
7 the first block of the repeatable sequence to the end of the last
8 block of the repeatable sequence) does not alter the duration of
9 the looping sequence (i.e., repeating a twenty second portion
10 thirty-five times or repeating a thirty-five second portion
11 twenty times both result in the same extended durations), the
12 aesthetic effect of such sequences are generally effected by the
13 principal duration 62. Accordingly, it is preferable that the
14 block sequence compiler 16 accept directions via user interface
15 17 to determine the sequence of blocks according to duration 42.

16 Accordingly, using the exemplary flow chart of FIG. 6,
17 a user specifies duration 42 to specify the principal duration
18 62. FIG. 7 shows the processing of the data of FIG. 8 according
19 to the flow chart of FIG. 6 for a principal duration of thirty-
20 five seconds (compiling sequences ABCDEFGJ and ABCDEFHE).
21 Accordingly, it is noted that while the end block of the
22 principal loop may have an ending attribute 36 (e.g., block E),
23 this is not a requirement of the algorithm of FIG. 6.
24 Additionally, FIG. 7 shows the alternative processing when the
25 algorithm of FIG. 6 is altered to eliminate the restriction
26 (specified in program step 64) that requires that the compiled
27 sequence begin with a block having a beginning attribute 36.
28 Consequently, a sequence of CDEFGHIJ is compiled.

1 In a next variation, e.g., in a visual environment,
2 portions of the source audio and/or video segment 28 are
3 determined which can play equally well in a forward or in a
4 reverse direction. Accordingly, an infinite loop can be defined
5 by selecting a sequence of compatible blocks accordingly to
6 compatibility list 38 that additionally have a reversible
7 attribute 66 set. Accordingly, if block sequence compiler 16
8 operates on the data of FIG. 10 according to the algorithm of
9 FIG. 9 and a prescribed duration 42 of twenty seconds, a sequence
10 of CDEF, CDCD, or CDED will result. When played, these sequences
11 will preferably reverse in direction at the end of the last block
12 and at the beginning of the first block (when being played
13 backwards).

14 While the above description has primarily discussed
15 uses where the entire sequence is repeatable, alternative uses
16 are also considered within the scope of the present invention.
17 For example, the repeatable sequence could be only a portion,
18 i.e., a subsequence, of the compiled output sequence. In an
19 exemplary case, a first portion of the output sequence is
20 compiled according to first user-specified duration (J), a second
21 portion of the output sequence is compiled according to a second
22 user prescribed principal duration (K) that is repeatable a user-
23 specified number of times (L), and a third portion of the output
24 sequence is compiled according to a third user-specified duration
25 (M). Consequently, the resulting duration will be $J+(K*L)+M$.

26 As described, embodiments of the invention are
27 suitable for generating audio and/or video output sequence
28 suitable for presentation on a single output channel, e.g., as a

1 single audio track, a single MIDI output, a single video clip
2 output, a single animation, etc. In an exemplary use, it may be
3 required to compile a thirty second video sequence as a video
4 output to combine with an existing audio track, e.g., assorted
5 pictures of a new car with a predefined description of its
6 features, or to add a musical interlude to a predefined video
7 clip, and thus create a car commercial. However, it may also be
8 desirable to compile both a video sequence and an audio sequence
9 to satisfy the user-defined duration criteria 42, e.g., thirty
10 seconds. However, it will generally be significant that the
11 audio and video channels correlate, e.g., an audio track
12 describing braking characteristics should not be combined with
13 video clips of crash tests. Therefore, FIG. 11 shows a
14 simplified block diagram of an embodiment that enables compiling
15 (using multiple block sequence compilers 16a-16n or preferably by
16 time sharing a single block sequence compiler 16) multiple
17 channels of audio and video 68a-68n, i.e., multimedia, and cross-
18 correlating the potential block sequence lists 19 using cross-
19 correlator 70 to ensure compatibility between the multiple
20 channels. To achieve this task, the cross-correlator 70 operates
21 upon additional compatibility data 38, e.g., data which shows the
22 interblock compatibility between the blocks in each channel 68,
23 i.e., interchannel compatibility. For the example of FIG. 12,
24 the characteristic table 30 contains additional compatibility
25 data 38 to ensure that BLOCK 1_n is compatible with both BLOCK 1_1
26 and BLOCK 2_1 (since the blocks sizes are not the same on CHANNEL₁
27 and CHANNEL_n, BLOCK 1_n overlaps both BLOCK 1_1 and a portion of
28 BLOCK 2_1).

1 Although the present invention has been described in
2 detail with reference only to the presently-preferred
3 embodiments, those of ordinary skill in the art will appreciate
4 that various modifications can be made without departing from the
5 invention. Accordingly, the invention is defined by the
6 following claims.

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ABSTRACT OF THE DISCLOSURE

A block sequence compiler for compiling a sequence of audio and/or video blocks (e.g., audio tracks, MIDI, video clips, animation, etc.) suitable for producing one or more audio and/or video output sequences (i.e., audio, video, or multimedia) each having a duration corresponding to user-prescribed criteria. In a preferred embodiment, a user chooses an audio and/or video source segment from a predefined library and prescribes the duration of an audio and/or video sequence. Prior to depositing each audio and/or video segment in the library, the segment is partitioned into audio and/or video blocks that are identified in a corresponding characteristic data table with characteristics including (1) duration, (2) suitability for being used as a beginning or ending of an audio and/or video sequence, and (3) compatibility with each block. Using this characteristic table and the user-prescribed criteria, i.e., duration, the block sequence compiler generates a plurality of audio and/or video sequences satisfying the user-prescribed criteria which can be reviewed, e.g., played, and/or saved for future use.

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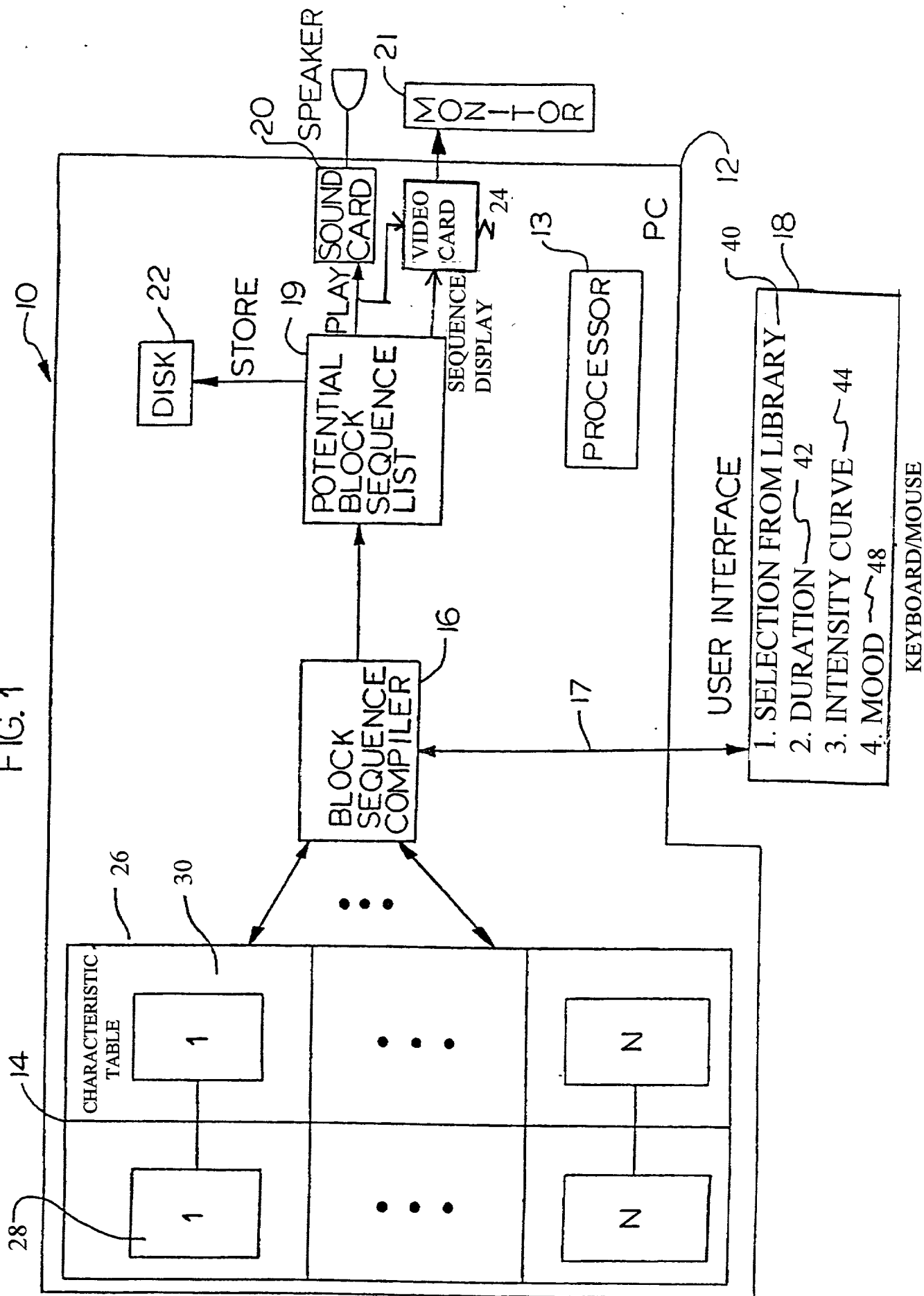
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FIG. 1



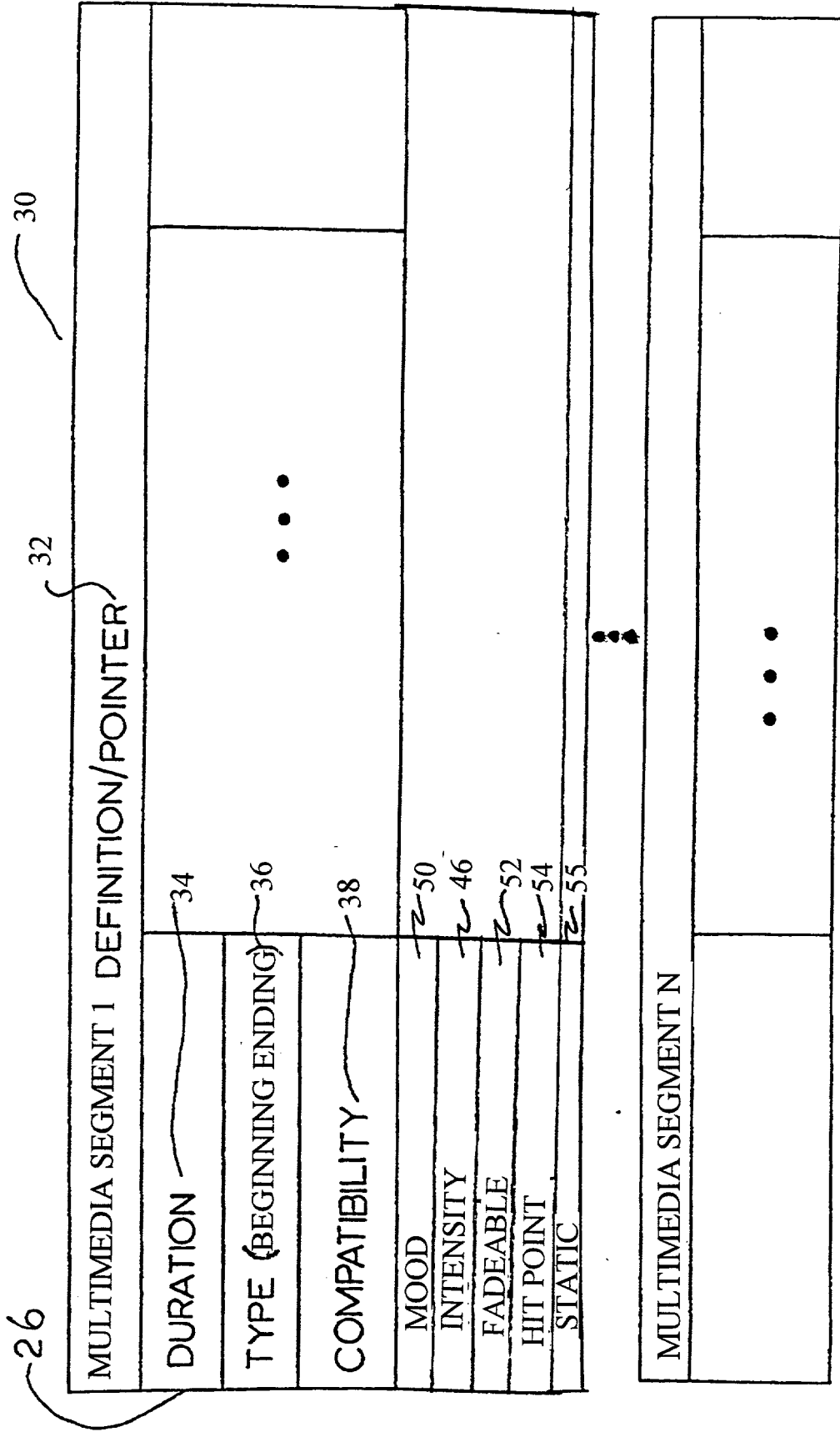


FIG. 2

Block Diagram

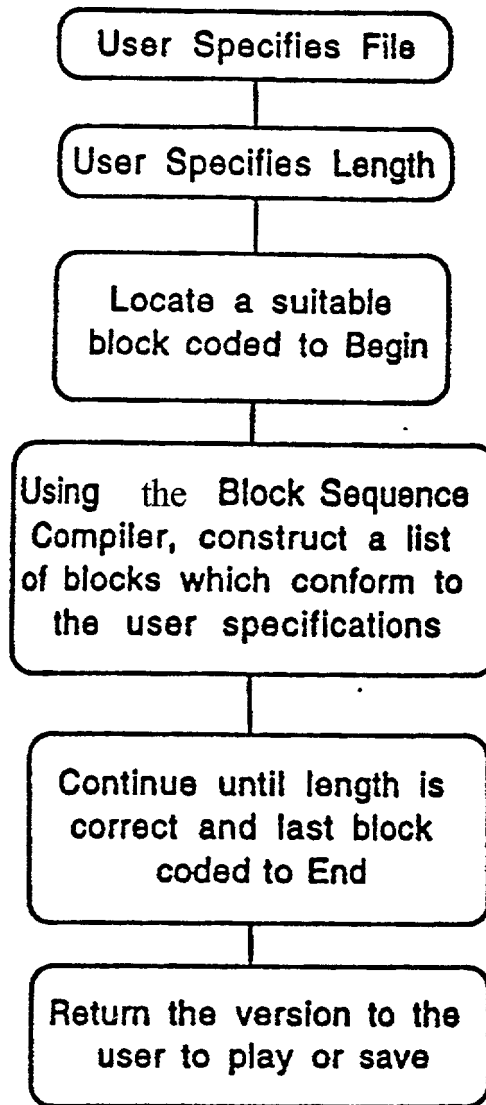


FIG. 3A

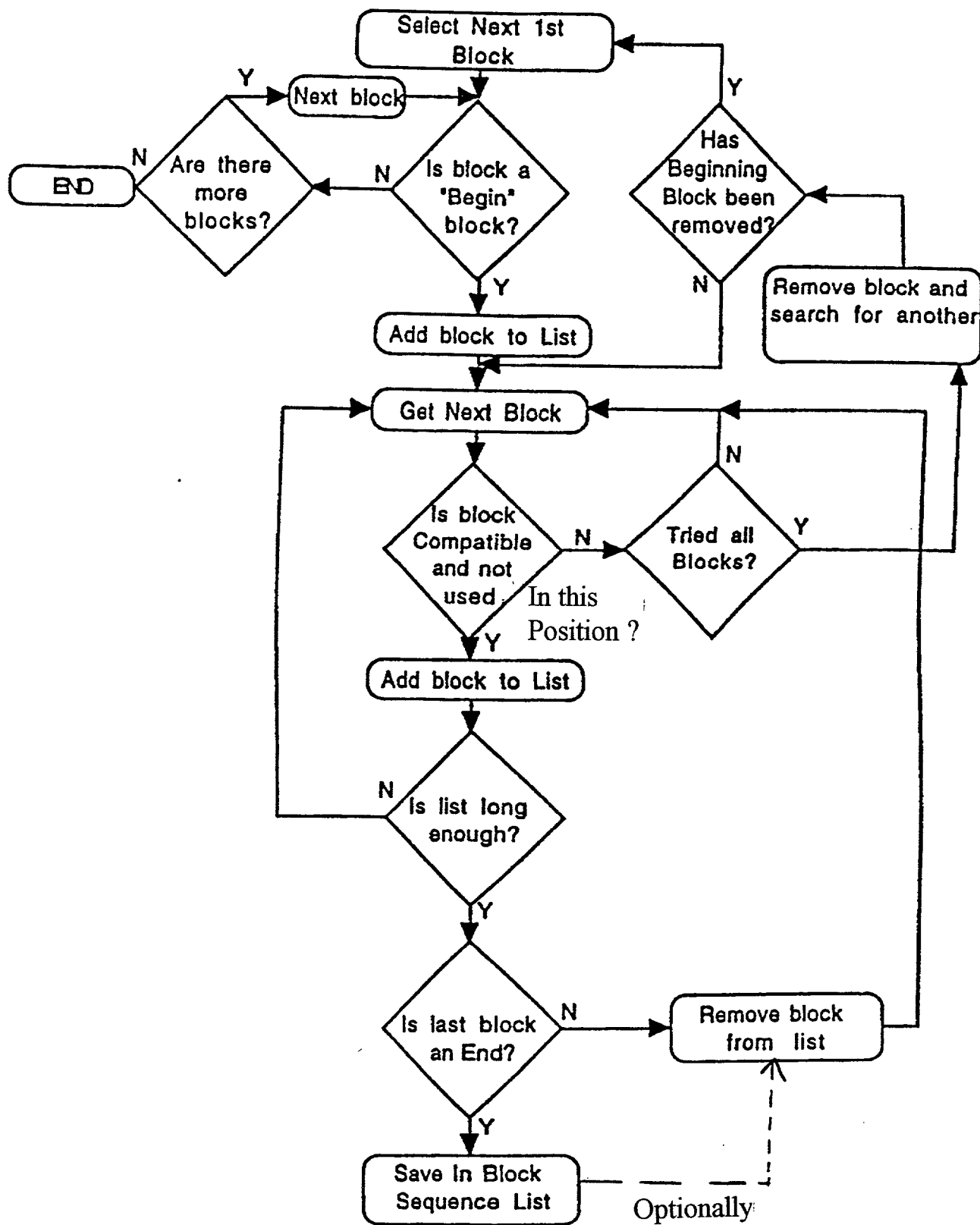


FIG. 3B

Optionally
Compile
Next
Sequence

30										
	A	B	C	D	E	F	G	H	I	J
DURATION 34	5	5	5	5	5	5	5	5	5	5
BEGINNING/ ENDING 36	B		B		E					E
COMPATIBILITY LIST 38	B									
		C						E		
			D	E	F	G H	H	I	J	

FIG. 4

\	0	1	2	3	4	5	6	7	\	
	A									length = 5
	A	B								length = 10
	A	B	C	D	E	F	G			length = 30
	A	B	C	D	E	F	G	H		length = 35
	A	B	C	D	E	F	G	H		length = 35
	A	B	C	D	E	F	G			length = 30
**	A	B	C	D	E	F	G	J		length = 35
	A	B	C	D	E	F	G			length = 30
	A	B	C	D	E	F	G			length = 30
	A	B	C	D	E	F	G			length = 30
	A	B	C	D	E	F				length = 25
	A	B	C	D	E	F	H			length = 30
	A	B	C	D	E	F	H	*		length = 30
**	A	B	C	D	E	F	H	E		length = 35
	C									length = 5
**	C	D	E	F	G	H	I	J		length = 35

A is the first block considered and it is a beginning so it is put in slot 1
 B is considered next and it is checked for compatibility with A
 *
 slots continue to be filled until...
 the length is >= the desired length
 H is checked as an ending, it is not so it is removed
 I is tried and not compatible with G, so J is tried next
 *** J is compatible with G and it is an ending, so this sequence is returned **
 *
 A SEQUENCE IS RETURNED
 *
 to continue looking for the next combination, J is removed
 J is the last block so A is tried next...
 blocks A - G are tried (H was the first one tried in this slot) and none are compatible
 so G is removed from slot 6
 H is compatible with F, so it is put in slot 6
 I, J, A, B, C, D are all tried in slot 7 and either not compatible or not endings
 *** E is both compatible and an ending, so this sequence is returned **
 *
 PROCESS CONTINUES...
 *
 basic SEEDING is performed by putting another beginning block in the first slot
 *** and building a sequence from there. **

FIG. 5

```

graph TD
    Start([Start]) --> SelectNext[Select Next 1st Block]
    SelectNext --> NextBlock[Next block]
    NextBlock --> IsBegin{Is block a "Begin" block?}
    IsBegin -- Y --> AddBlock1[Add block to List]
    IsBegin -- N --> AreMore{Are there more blocks?}
    AreMore -- Y --> GetNext[Get Next Block]
    AreMore -- N --> RemoveSearch[Remove block and search for another]
    GetNext --> IsCompatible1{Is block Compatible and not used In this Position?}
    IsCompatible1 -- Y --> AddBlock2[Add block to List]
    IsCompatible1 -- N --> TriedAll{Tried all Blocks?}
    TriedAll -- Y --> RemoveSearch
    TriedAll -- N --> RemoveSearch
    AddBlock2 --> IsListLong{Is list long enough?}
    IsListLong -- Y --> IsLastCompatible{Is Last block Compatible with First Block?}
    IsListLong -- N --> RemoveSearch
    IsLastCompatible -- Y --> SaveList[Save In Block Sequence List]
    IsLastCompatible -- N --> RemoveSearch
    SaveList --> Compile[Optionally Compile Next Sequence]
    Compile --> RemoveSearch
    RemoveSearch --> RemoveBlock[Remove block from list]
    RemoveBlock --> RemoveSearch

```

FIG. 6

FIG. 6

Optionally
Compile
Next
Sequence

0	1	2	3	4	5	6	7	
A								length = 5
								A is the first block considered and it is a beginning so it is put in slot 1
A	B							length = 10
								B is considered next and it is checked for compatibility with A
								*
A	B	C	D	E	F	G		length = 30
								slots continue to be filled until...
A	B	C	D	E	F	G	H	length = 35
								the length is >= the desired length
A	B	C	D	E	F	G	H	length = 35
								H is checked for compatibility with the first block (A), it is not so it is removed
A	B	C	D	E	F	G		length = 30
								I is tried and not compatible with G, so J is tried next
								*** J is compatible with G and the first block (A), so this sequence is returned **
								A SEQUENCE IS RETURNED
								to continue looking for the next combination, J is removed
A	B	C	D	E	F	G		length = 30
								J is the last block so A is tried next...
A	B	C	D	E	F	G		length = 30
								blocks A - G are tried (H was the first one tried in this slot) and none are compatible
A	B	C	D	E	F			length = 25
								so G is removed from slot 6
A	B	C	D	E	F	H		length = 30
								H is compatible with F, so it is put in slot 6
A	B	C	D	E	F	H	*	length = 30
								I, J, A, B, C, D are all tried in slot 7 and either not compatible or not compatible with the first block (A)
								*** E is both compatible with H and the first block (A), so this sequence is returned **
								*
								OR ALTERNATIVELY WITH STEP 44 BYPASSED...
								*
								length = 5
								basic SEEDING is performed by putting another beginning block in the first slot (Note C is not a beginning block)
								*** and building a sequence from there. **
								Note J is compatible with I and C is compatible to follow J

FIG. 7

30

	A	B	C	D	E	F	G	H	I	J
DURATION ~ 34	5	5	5	5	5	5	5	5	5	5
BEGINNING/ ENDING ~ 36	B				E					
COMPATIBILITY LIST ~ 38	B	C	D	E	A	C	D	E	J	A
					F	G	H	I		C

FIG. 8

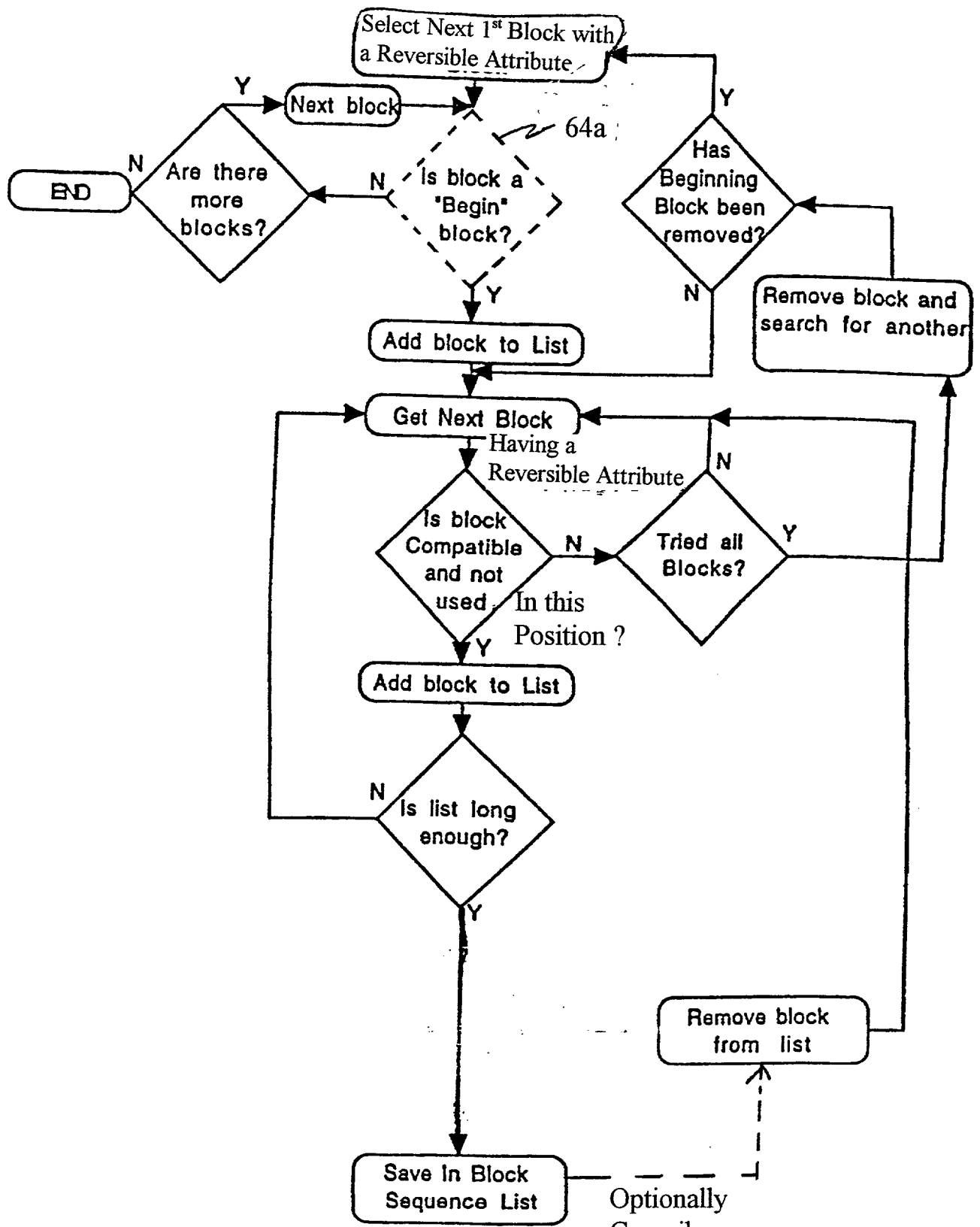


FIG. 9

Optionally
Compile
Next
Sequence

30

	A	B	C	D	E	F	G	H	I	J
DURATION ~ 34	5	5	5	5	5	5	5	5	5	5
BEGINNING/ ENDING ~ 36	B		B		E					E
COMPATIBILITY LIST ~ 38	B	C		C	D	E		E		
						F	G	H	I	J
REVERSIBLE ~ 66			X	X	X	X				

FIG. 10

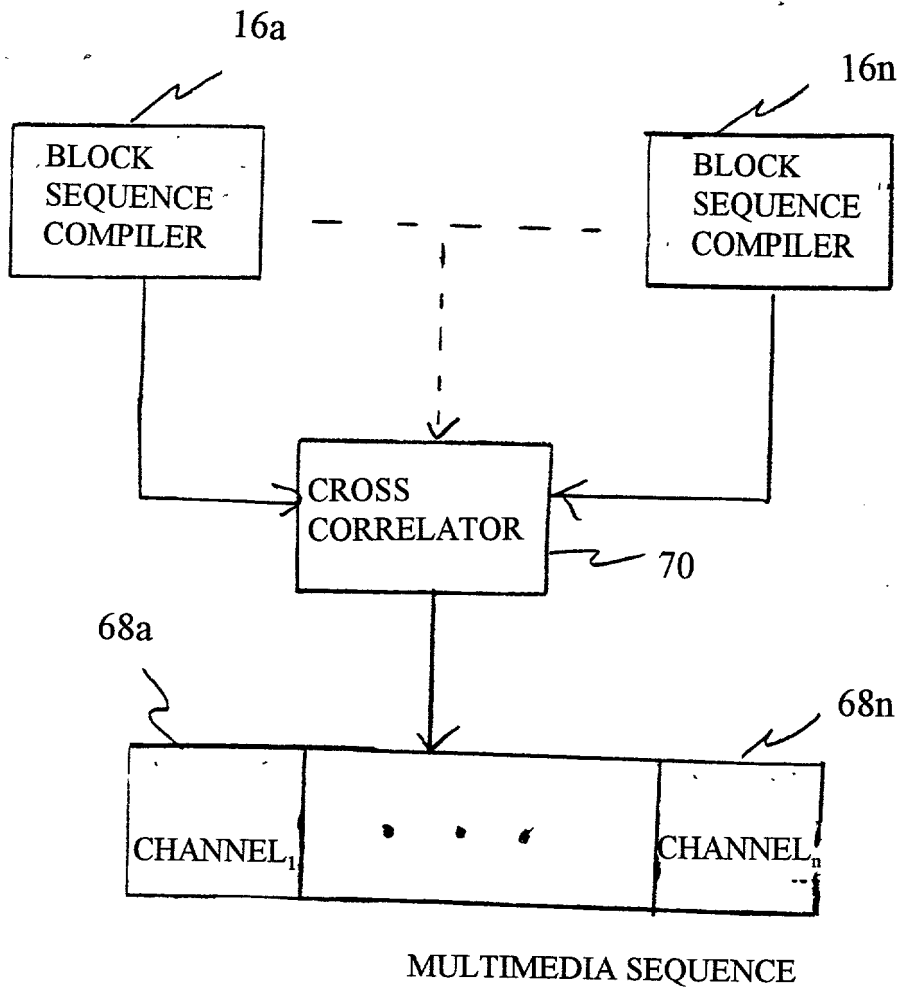


FIG. 11

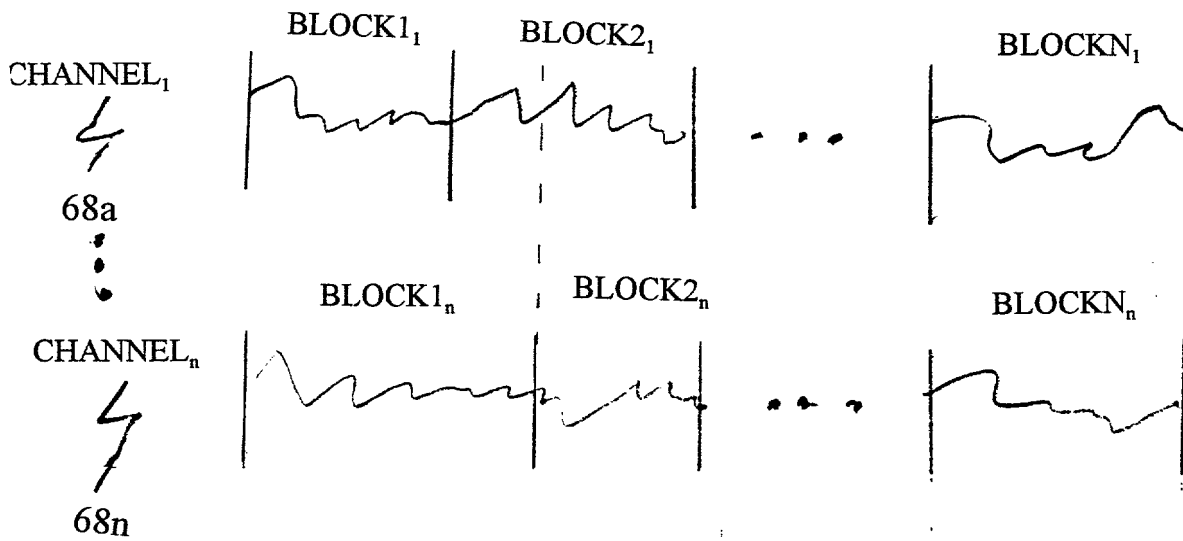


FIG. 12

CLAIMS

We claim:

1. A system for compiling a sequence of blocks suitable for producing an audio and/or video output sequence having a prescribed duration, said system comprising:

a stored data table referencing one or more audio and/or video source segments wherein said table contains entries to partition each of said segments into multiple data blocks;

said table entries defining the characteristics of each block including its duration, its suitability to begin or end a sequence, and its interblock compatibility;

a user interface for enabling a user to prescribe a sequence duration; and

a block sequence compiler for iteratively compiling a list of one or more sequences each comprised of a plurality of blocks selected according to said user-prescribed sequence duration such that each said sequence conforms with said table entries.

2. The system of claim 1 additionally comprising means for displaying said list.

3. The system of claim 1 additionally comprising means to store at least one said sequence from said list.

4. The system of claim 1 additionally comprising means to play a selected sequence from said list.

1 5. The system of claim 1 wherein said table
2 additionally comprises data corresponding to a mood parameter for
3 each said block and said user interface additionally enables a
4 user to prescribe a mood parameter and said block sequence
5 compiler selects blocks according to said user-prescribed mood
6 parameter.

7
8 6. The system of claim 1 wherein said table
9 additionally comprises data corresponding to a fadeable parameter
10 for each said block and said block sequence compiler selects an
11 ending block having said fadeable parameter set and wherein such
12 fadeable blocks can be truncated to achieve audio and/or video
13 sequences of said user-prescribed sequence duration.

14
15 7. The system of claim 1 wherein said table
16 additionally comprises data corresponding to an intensity
17 parameter for each said block and said user interface
18 additionally enables a user to prescribe an intensity curve and
19 said block sequence compiler selects blocks according to said
20 user-prescribed intensity curve.

21
22 8. The system of claim 1 wherein said table
23 additionally comprises data corresponding to a hit point
24 parameter for each said block for specifying when an intensity
25 burst is present within said block and said user interface
26 additionally prescribes an intensity burst location and said
27 block sequence compiler compiles sequences of said blocks
28 according to said user-prescribed intensity burst location.

1 9. The system of claim 1 wherein said user interface
2 additionally enables a user to prescribe one of said audio and/or
3 video source segments and said processor compiles sequences of
4 blocks selected from said user-prescribed segment.

5
6 10. The system of claim 1 wherein said table
7 additionally comprises data corresponding to a static parameter
8 for each said block and said block sequence compiler can select
9 a ending block having said static parameter set and wherein such
10 static blocks can be extended to form sequences of said user-
11 prescribed duration.

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1 11. A method for compiling a sequence of blocks
2 suitable for producing an audio and/or video output sequence of
3 a prescribed duration, said method comprising the steps of:

4 providing data corresponding to at least one
5 audio and/or video source segment;

6 defining multiple data blocks corresponding to
7 portions of said source segment and indicating characteristics
8 corresponding to the duration of each block;

9 assigning characteristics to each block
10 corresponding to the suitability of each block to begin or end a
11 sequence and the interblock compatibility of each block;

12 defining a desired duration for an output
13 sequence; and

14 iteratively compiling a list of one or more
15 sequences each comprised of a plurality of blocks according to
16 said desired duration such that each said sequence conforms with
17 said characteristics of each block.

18
19 12. The method of claim 11 additionally comprising
20 the step of selecting one of said source segments and wherein
21 said iteratively compiling step compiles sequences of blocks from
22 those blocks corresponding to said selected segment.

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24 13. The method of claim 11 additionally comprising
25 the step of displaying said compiled list.

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1 15. A method for compiling a sequence of blocks
2 suitable for producing an audio and/or video output sequence of
3 a prescribed duration from an audio and/or video source segment
4 having multiple data blocks corresponding to portions of said
5 source segment and indicating characteristics of each block
6 corresponding to its duration, its suitability of each block to
7 begin or end a sequence, and its interblock compatibility, said
8 method comprising the steps of:

9 defining a desired duration for an audio and/or
10 video output sequence; and

11 iteratively compiling a list of one or more
12 sequences each comprised of a plurality of blocks according to
13 said desired duration such that each said sequence conforms with
14 said characteristics of each block.

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1 16. A system for compiling a sequence of blocks
2 suitable for producing a repeatable audio and/or video output
3 sequence having a prescribed duration, said system comprising:
4 a stored data table referencing one or more audio
5 and/or video source segments wherein said table contains entries
6 to partition each of said segments into multiple data blocks;
7 said table entries defining the characteristics
8 of each block including its duration and its interblock
9 compatibility;
10 a user interface for enabling a user to prescribe
11 a sequence duration; and
12 a block sequence compiler for iteratively
13 compiling a list of one or more repeatable sequences each
14 comprised of a plurality of blocks selected to conform to said
15 user-prescribed sequence duration and such that each said
16 sequence conforms with said table entries.

17
18 17. The system of claim 16 additionally comprising
19 means for displaying said list.

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21 18. The system of claim 16 wherein each said
22 repeatable sequence comprises at least a first block and a last
23 block and wherein said last block of each said repeatable
24 sequence is selected such that the first block of each said
25 repeatable sequence is compatible, according to said table
26 entries, to sequentially follow said last block of each said
27 repeatable sequence.

28 //

1 19. The system of claim 16 wherein said table entries
2 additionally include a reversible parameter to identify blocks
3 suitable for playing both in a forward or in a reverse direction
4 and each said block selected by said block sequence compiler has
5 said reversible parameter set.

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08/532,527

DECLARATION FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

SYSTEM FOR GENERATING PRESCRIBED DURATION AUDIO AND/OR VIDEO SEQUENCES
the specification of which

X is attached hereto.
_____ was filed on _____ as Application Serial No. _____
_____ and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56(a),

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Number	Country	Date Filed	Yes	No
--------	---------	------------	-----	----

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Section 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

Appln. Ser. No.	Filing Date	Status-patented, pending, abandoned
08/532,527	9/22/95	Pending

I hereby appoint the following attorney(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

Arthur Freilich	Reg. No. 19,281	Timothy T. Tyson	Reg. No. 28,915
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10960 Wilshire Blvd., Suite 840
Los Angeles, California 90024-3704

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor GEOFFREY CALVIN HUFFORD
Inventor's Signature [Signature] Date 10/22/97
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Post Office Address SAME AS ABOVE

Full name of second joint inventor CHRISTOPHER P. HUFFORD
Inventor's Signature [Signature] Date 10/21/97
Residence 10035 FULLBRIGHT AVE. CHATSWORTH, CA 91311 Citizenship U.S.
Post Office Address SAME AS ABOVE

Full name of third joint inventor KEVIN C. KLINGLER
Inventor's Signature [Signature] Date 10/21/97
Residence 9527 FULLBRIGHT AVE. CHATSWORTH, CA 91311 Citizenship U.S.
Post Office Address SAME AS ABOVE

Applicant or Patentee: GEOFFREY C. HUFFORD, CHRISTOPHER P. HUFFORD, and KEVIN C. KLINGLER
Serial or Patent No.: _____ Filed or Issued: _____
For: SYSTEM FOR GENERATING PRESCRIBED DURATION AUDIO AND/OR VIDEO SEQUENCES
VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) and 1.27(c) - SMALL BUSINESS CONCERN

I hereby declare that I am
_____ the owner of the small business concern identified below:
☒ an official of the small business concern empowered to act on behalf of the concern
identified below:
NAME OF CONCERN: SONIC DESKTOP SOFTWARE
ADDRESS OF CONCERN: P.O. Box 3205, CHATSWORTH, CA 91313-3205

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention, entitled SYSTEM FOR GENERATING PRESCRIBED DURATION AUDIO AND/OR VIDEO SEQUENCES by inventor(s) GEOFFREY C. HUFFORD, CHRISTOPHER P. HUFFORD, and KEVIN C. KLINGLER described in

☒ the specification filed herewith
_____ Application Serial No. _____ filed on _____
_____ and was amended on _____ (if applicable).
_____ patent no. _____, issued _____.

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed below* and no rights to the invention are held by any person, other than the inventor, who could not qualify as a small business concern under 37 CFR 1.9(d) or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e). *NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

NAME _____
ADDRESS _____
Individual _____ Small Business Concern _____ Nonprofit Organization _____

NAME _____
ADDRESS _____
Individual _____ Small Business Concern _____ Nonprofit Organization _____

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING KEVIN C. KLINGLER
TITLE OF PERSON OTHER THAN OWNER PRESIDENT
ADDRESS OF PERSON SIGNING P.O. Box 3205, CHATSWORTH, CA 91313-3205

Kevin C. Klingler _____
Signature Date 10/21/97